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SINGLE PARTICLE LASER ABLATION TIME-OF-FLIGHT MASS SPECTROMETER: MAIDEN VOYAGE TO HOUSTON, TX

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Abstract

BNL Single Particle Laser Ablation Time-of-flight Mass Spectrometer (SPLAT-MS) was designed for *in-situ* characterization of the size and composition of individual aerosols. The aerodynamic lens serves as the sampling inlet. It focuses over 90 percent of entrained particles in the 50nm to 1000nm size range into a well-defined beam of less than 1mm diameter with very low divergence. Two stages of optical detection are used to indicate the presence of particles larger than 50nm and for velocity/size determination. The ablation laser is fired synchronously with the particle's arrival at the inlet to the TOF-MS, it ablates the particle producing ionic fragments for mass spectroscopic analysis by a reflectron time-of-flight mass spectrometer. The resolution of the instrument in mass-to-charge units is 1000. The TOF-MS spectra are digitized at a rate of 500 MHz, and data is transferred to the computer. A very rapid transfer rate of 100 MB/sec allows for high-resolution mass analysis of 20 particles per second.

The instrument was deployed for its maiden voyage during the Texas 2000 Air Quality Study in Houston, TX, where it was located on a tall building (300m) near the west of the Houston city center. Over 230,000 particles in size range from 50nm to 3500nm were detected, sized and their composition characterized.

Preliminary results of data analysis and visualization will be presented in the context of the overall TX 2000 field campaign. So far 25 particle classes and subclasses were identified and examined based on multivariate binary classification of the TX 2000 data set. The data indicate that the two most abundant types of particles in Houston, TX were sulfate and organic containing particles and that most often these two very broad classes overlap, since many of the sulfate particles were internally mixed with organics. High instrument sampling rate of approximately 2 particles per seconds and the developed visualization and analysis tools allow for an explorations of the data with high resolution in time, size and class, which will be illustrated on the example of the power plant plume episode.

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